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SPECIFICATION OF THE INVENTION TO THE AUTHORSHIP CERTIFICATE

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(72) R.V.Novichihin, S.N.Postnikov and L.A.Ryabinin

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(56) 1. The USSR Authorship Certificate

No. 705397, cl. G 01 R 33/16, G 01 V 3/10, 1977.

2. The USSR Authorship Certificate No. 661448, cl. G 01 R 33/02, 1975.

(54) (57) INDUCTION TRANSDUCER comprising a measuring, a compensating and a perpendicular thereto actuating windings, characterized in that, with the purpose to increase sensitivity and spatial selectivity the compensating winding is provided with a mechanism for moving thereof along the axis, the windings are arranged on an antimagnetic dielectric spool, and the actuating windings are formed flat with an inner diameter smaller than the inner diameter of the measuring and the compensating windings.

The invention relates to the field of magnetic measuring and can be used for an object magnetic properties analysis and for nondestructive test.

It is known a transducer comprising opposite connected two sections of a receiving coil, placed inside an actuating coil coexially and symmetrically thereto. This device is also formed as an air transformer, but differs in parallel arrangement of the actuating and the receiving coils,

thus the initial excitation flux penetrates the receiving coils in one direction, creating therein during the measuring equally directed changes of electromotive force which difference represents the output signal [1].

Value of the initial current coupling with the receiving coils remains practically constant during the measuring and does not depend on the measured value. All this alongside with absence of the initial signal neutralization causes low sensitivity and poor precision of this device.

It is also known a transducer comprising a magnetic circuit in form of a coaxial tube and a core with radial crossbars in the medial part, and magnetizing coils are placed thereon. A measuring and compensating (receiving) windings are symmetrically installed on the core at both sides of the crossbars [2].

Change of the measured value in this transducer results in opposite changes of the electromotive force in the receiving windings that raises sensitivity. However sensitivity of this transducer is not high either, since whole magnetic flux created by the magnetizing coil transits through the magnetic circuit with receiving windings, and introducing of a measuring object into the field of transducer practically does not change the aggregate initial flux penetrating the receiving windings, but redistributes this flux therebetween. This device also has a deficiency in that the initial signal appears not completely compensated because of non-identical receiving windings and their magnetic circuits that adversely affects the measuring precision and resolution. Besides the known transducer has a significant size of the sensing zone that impedes its use for measuring in localized zones, on rough surfaces and also fine objects.

It is an object of the invention to increase sensitivity and spatial selectivity.

This object is achieved by that in the induction transducer comprising a measuring, a compensating and a perpendicular thereto actuating windings, the compensating winding is provided with a mechanism for moving thereof along the axis, the windings are arranged on an antimagnetic dielectric spool, and the actuating windings are formed flat with an inner diameter

smaller than the inner diameter of the measuring and the compensating windings.

Fig. 1 shows an electric circuit of the transducer; Fig. 2 represents the transducer design; Figs. 3 and 4 show two projections of the device with conventionally shown allocation of magnetic lines of force at absence of the measuring object; Figs. 5 and 6 show the same, close to the object.

The actuating windings 2 opposite connected therebetween are installed on a housing 1 (Fig. 2), formed from an antimagnetic dielectric material (Fig. 1). Perpendicularly to the axis of the actuating windings 2 there are placed spools 3 and 4 of a similar material with a measuring winding 5 and a compensating winding 6 connected in-series and additively therebetween (Fig. 1), a moving mechanism 7 for moving spool 4 along the axis is formed, for example, as a threaded pair.

The transducer works as follows.

The actuating windings 2 are connected to an alternating-current source. At absence of the measuring object (Figs. 3 and 4) the transducer actuating winding 2 forms in space alternating magnetic flux divergent symmetrically in all sides from its axis and looped on the other end of the winding. This flux induces in the identical measuring winding 5 and compensating winding 6 identical on amplitude, but opposite on phase electromotive forces which compensate each other, and initial difference signal of the transducer is equal to zero. The complete neutralization is achieved by moving the compensating winding 6 along the axis. Introducing of magnetic objects into the actuating (initial) field of the transducer 8 (Figs. 5 and 6) induces in the latter a secondary magnetic field which flux increases the initial flux through the measuring winding 5 and compensates a part of the initial flux through the winding 6. Besides symmetry of the initial flux is also broken due to drift and concentration to the side of the object having magnetic conductivity greater than air. Thus the magnetic flux through the compensating winding 6 decreases, and through a measuring winding 5 increases, even more strengthening dependence of the receiving windings difference signal on the measured value which is magnetic conductivity

of the object or distance thereto.

The same result is achieved if instead of two receiving windings only one winding is used movable along the axis and placed with the axis of the magnetizing coils crossing it in a medial part. Thus the movement necessary for neutralization of the initial signal is twice less.

Two actuating windings are used for localization and increasing of the field homogeneity in the measuring zone. When more windings of this kind are used a strong spatial restriction of the initial field is achieved and reduced sensitivity. Outside diameter of the receiving windings is accepted depending on desirable size of the sensing zone.

Use of a spool from an antimagnetic and nonconductive material with the proposed coils layout allows to use at measuring a spatial change of the actuating field at presence of an object which alongside with registration of the result of interaction of the actuating (initial) field with a field induced in the object (secondary field), provides an additional source of information, allowing to increase sensitivity of the transducer. The formed distribution in space of the actuating field enables to change electromotive force by moving the compensating winding and to completely compensate the initial signal thus increasing accuracy of the measurement. The sensitivity zone is defined by diameter of the measuring coil, arrangement and shape of the actuating coils.